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VARIANTS OF *HEXAGENIA* S.S. SPECIES AFFECTING SUBGENERIC DIAGNOSIS (EPHEMEROPTERA: EPHEMERIDAE)[1]

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Abstract.—Adult variants of two species of *Hexagenia* s.s. from eastern North America cannot be identified to the correct subgenus with the use of present keys. Existent differentiating characters of male genitalia and wing venation are qualified by taking into account the described variants and the zoogeography of the subgenera.

Hexagenia Walsh is one of the most common and well known genera of Ephemeroptera in North America. These mayflies are extraordinary because of their relatively large size along with their propensity for occurring in large numbers and mass emergences. Adults are usually identifiable to subgenus and species with the use of published keys.

Spieth (1941) divided the group into two subgenera (Nearctic *Hexagenia* s.s. and Neotropical *Pseudeatonica* Spieth) based on adult morphological differences. The zoogeographic distinctiveness of the subgenera was reaffirmed by McCafferty (1968). Demoulin (1958, 1970) listed *Pseudeatonica* as a subgenus of the African genus *Eatonica* Navas rather than *Hexagenia*, and Kimmins (1960) accorded full generic status to *Pseudeatonica*. Subsequent discoveries of the larval stage of *Pseudeatonica* (McCafferty, 1970) and *Eatonica* (McCafferty, 1971) have clearly shown the latter two classificatory moves to be inappropriate and have substantiated Spieth's original concept. *Pseudeatonica* larvae are essentially symmorphic with those of *Hexagenia* s.s.

Spieth (1941) distinguished *Pseudeatonica* adults from those of *Hexagenia* s.s. primarily by the former's possession of three rather than four segmented male genital forceps. He also indicated that the fore wings of *Pseudeatonica* had 4–6 A_1 veinlets while those of *Hexagenia* s.s. had 8 or 9. McCafferty (1970) reported 5–14 veinlets (but usually 8 or more) in *Hexagenia* s.s. Edmunds et al. (1976) distinguished the subgenera on the basis

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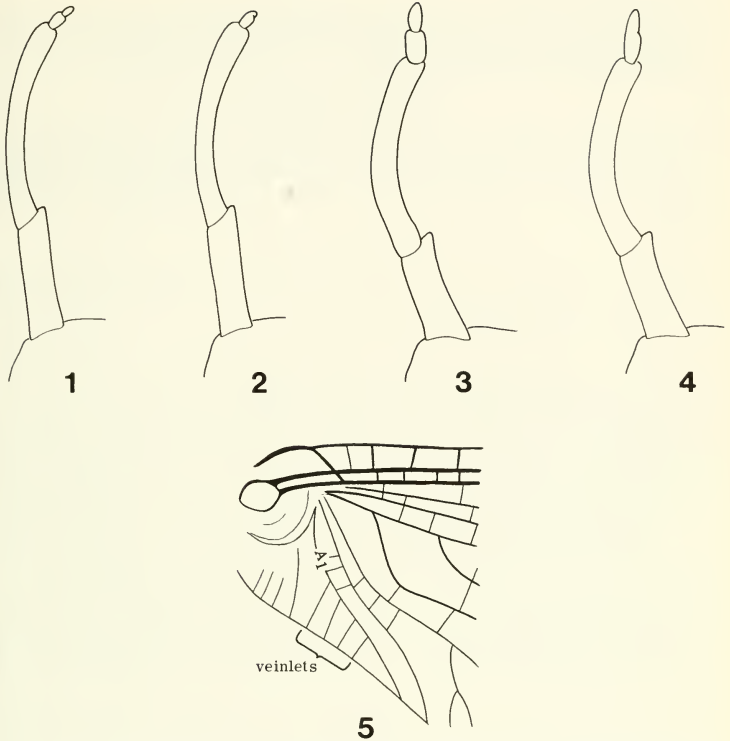
of the above genitalic differences and indicated that *Hexagenia* s.s. had 8 or more A_1 veinlets while *Pseudeatonica* had 6 or fewer.

Examinations of *Hexagenia* specimens from eastern and central North America have revealed that some are not identifiable to subgenus using the above characteristics. Since these characteristics form the basis of Spieth's (1941) key to *Hexagenia* species (first couplet) and the Edmunds et al. (1976) key to *Hexagenia* subgenera and are undoubtedly relied on heavily for species identification, and since samples often exist of only one or a few specimens, it is important to note the exceptions and delineate the subgenera more completely.

One adult male examined from the United States National Museum (Maryland, Worcester Co., Milburn Landing, 29 July 1972, J. & A. Cross) proved to be a typical specimen of *Hexagenia* (*Hexagenia*) *munda* Eaton in all characters except the forceps segmentation. It possesses only 1 short terminal segment (Fig. 2). Originally this was considered to be an aberrant individual of little concern. I have since examined *H. munda* material from Wisconsin which show a distinct deterioration of the terminal segmentation of the forceps in about one-third of the males and resemble the Maryland variant. Both four segmented and three segmented forceps occur within the same populations in Wisconsin, and a few individuals are asymmetrical in this regard.

Recently, I have examined another adult male of *Hexagenia* s.s. retained by the Maryland Water Resources Administration and preliminarily identified as *Pseudeatonica* which is also subgenerically problematic. This specimen (Patapsco R., Hollowfield, Maryland, 24 August 78, G. Harman) proved to be *Hexagenia atrocaudata* McDunnough but possesses genitalia (Fig. 4) and A_1 venation (Fig. 5) more typical of *Pseudeatonica*, i.e., the forceps have 1 small terminal segment and the fore wings have 4 A_1 veinlets. Further examination of *H. atrocaudata* specimens (both male and female) from throughout the species' range revealed that the number of veinlets extending from A_1 to the anal margin of the fore wings ranges from 4–8 although there often an additional 1 or 2 small incomplete veinlets (not attached to A_1). The forceps are normally distinctly four segmented. Variants of the genital forceps encountered in *H. munda* and *H. atrocaudata* are shown in Figures 1–4.

The use of A_1 veinlet numbers should be abandoned as a subgeneric distinguishing character. Segmentation of the genital forceps may continue to be regarded as a fundamental subgeneric character but must be qualified as a key character due to occasional variants of *Hexagenia* s.s. Because of the limited number of *Pseudeatonica* adults that I have been able to study, I am reluctant to offer additional characters to delimit the subgenera. I have not yet seen males or females of *Pseudeatonica* which possess bicolorous (divided ventro-laterally) compound eyes as is the condition present in all



Figs. 1–4. Male forceps. 1, *Hexagenia munda*, four segmented. 2, *H. munda*, three segmented. 3, Typical *H. atrocaudata*. 4, Atypical *H. atrocaudata*. Fig. 5. Anal area of fore wing, *H. atrocaudata*.

Hexagenia s.s. males. Also the compound eyes of *Pseudeatonica* are slightly convergent ventrally as seen in facial view, whereas those of *Hexagenia* s.s. tend to be convergent dorsally, especially so in the males. These differences may eventually prove to be consistent. The subgenera are obviously very closely related sister groups (McCafferty, 1973).

The respective geographic ranges of the subgenera are reliably diagnostic in most cases. Only *Hexagenia* s.s. occurs north of Mexico and only *Pseudeatonica* occurs in South America. The occurrence of *Pseudeatonica* in the U.S. or Canada would be extremely improbable. Eventually the subgenera may be found to overlap in southern Mexico and Central America.

For this region both the venational and genitalic characters stated by authors previously can be used with confidence since *H. atrocaudata* and *H. munda* do not occur as far south as Mexico.

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